Amendments to the Claims:

Claims 1-28 were pending at the time of the Office Action.

Claims 1 and 14 are hereby amended.

Claims 1-28 remain pending.

1. (Currently Amended) A solid state thermal engine device for converting thermal energy into an electric current, the device <u>including</u> ~~includes~~ one or more thermal tunneling units, the one or more thermal tunneling units comprising:

a first metal electrode; and

a second metal electrode mated to the first metal electrode,

wherein an effective gap is formed between the first and second metal electrodes on the order of one nanometer,

<u>wherein the effective gap is formed by applying at least one of a voltage and a current across the mated electrodes to provide a rearrangement of a polycrystalline structure of the mated electrodes</u>.

2. (Original) The device of Claim 1, wherein at least one of the metal electrodes include a base metal and a metal deposited on the surface of the base metal, wherein the deposited metal cause the metal electrode to have a work function that is lower than the work function of the base metal.

3. (Original) The device of Claim 2, wherein the base metal includes one or more of Au, Pt, Pd, Ag, Si, W, or Cr.

4. (Original) The device of Claim 3, wherein the deposited metal includes at least one of Cs or CsO.

5. (Original) The device of Claim 1, wherein the one or more thermal tunneling units are formed within two bonded glass substrates.

6. (Original) The device of Claim 1, wherein the one or more thermal tunneling units are formed in two Si substrates with a removed inter-device silicon material.

7. (Original) The device of Claim 1, wherein the effective gap is generated by applying a voltage greater than a threshold voltage across the mated electrodes.

8. (Original) The device of Claim 1, wherein the effective gap is generated by applying a current greater than a threshold current across the mated electrodes.

9. (Original) The device of Claim 1, further comprising etched wells located between thermal tunneling units.

10. (Original) The device of Claim 1, further comprising metal plating located adjacent to each metal electrode.

11. (Original) The device of Claim 8, further comprising a conductive material located adjacent to the metal plating.

12. (Original) The device of Claim 1, wherein the metal electrodes include an alkali.

13. (Original) The device of Claim 1, wherein the effective gap is generated by annealing the metal electrodes thereby forming silicide.

14. (Currently Amended) A solid state thermal engine device for converting thermal energy into an electric current, the device comprising:

a first wafer portion including:

a first surface; and

a first metal electrode attached to the first surface; and

a second wafer portion including:

a second surface; and

a second metal electrode attached to the ~~first~~ second surface; the first surface of the first wafer portion being bonded to the second surface of the second wafer portion, and the first metal electrode of the first wafer portion is mated to the second metal electrode of the second wafer portion, such that an effective gap on the order of one nanometer is formed between the metal electrodes,

wherein the effective gap is formed by applying at least one of a voltage and a current across the mated electrodes to provide a rearrangement of a polycrystalline structure of the mated electrodes.

15. (Original) The device of Claim 14, wherein at least one of the metal electrodes include a base metal and a metal deposited on the surface of the base metal, wherein the deposited metal cause the metal electrode to have a work function that is lower than the work function of the base metal.

16. (Original) The device of Claim 15, wherein the base metal includes one or more of Au, Pt, Pd, Ag, Si, W, or Cr.

17. (Original) The device of Claim 16, wherein the deposited metal includes at least one of Cs or CsO.

18. (Original) The device of Claim 14, wherein the effective gap is generated by applying a voltage greater than a threshold voltage across the mated electrodes.

19. (Original) The device of Claim 14, wherein the effective gap is generated by applying a current greater than a threshold current across the mated electrodes.

20. (Original) The device of Claim 14, wherein the first and second wafers include glass.

21. (Original) The device of Claim 14, wherein the first and second wafers include SiO_2.

22. (Original) The device of Claim 14, wherein the first and second wafers are made of Si.

23. (Original) The device of Claim 14, further comprising a plurality of mated first and second metal electrode pairs.

24. (Original) The device of Claim 23, further comprising etched wells located between each mated first and second metal electrode pair.

25. (Original) The device of Claim 14, further comprising metal plating located adjacent to each first and second metal electrode.

26. (Original) The device of Claim 25, further comprising a conductive material located adjacent to the metal plating.

27. (Original) The device of Claim 14, wherein the first and second metal electrodes include an alkali.

28. (Original) The device of Claim 14, wherein the first and second wafers include a combination of Si and a metal as the metal electrodes and the effective gap is generated by annealing the first and second metal electrodes.

29. (Withdrawn) A method of making a solid state thermal engine device for converting thermal energy into an electric current, the method comprising:

etching a via through first sides of first and second substrates;

attaching metal electrodes to second sides of the first and second substrates, wherein the second sides are opposite the first sides; and

mating the metal electrodes by bonding the second side of the first substrate to the second side of the second substrate to form a solid state thermal engine device, wherein an effective gap is formed between the two electrodes on the order of one nanometer.

30. (Withdrawn) The method of Claim 29, wherein at least one of the metal electrodes include a base metal and a metal deposited on the surface of the base metal, wherein the deposited metal cause the metal electrode to have a work function that is lower than the work function of the base metal.

31. (Withdrawn) The method of Claim 30, wherein the base metal includes one or more of Au, Pt, Pd, Ag, Si, W, or Cr.

32. (Withdrawn) The method of Claim 31, wherein the deposited metal includes at least one of Cs or CsO.

33. (Withdrawn) The method of Claim 29, further comprising applying a voltage greater than a threshold voltage across the mated electrodes.

34. (Withdrawn) The method of Claim 29, further comprising applying a current greater than a threshold current across the mated electrodes.

35. (Withdrawn) The method of Claim 29, wherein the first and second substrates include glass.

36. (Withdrawn) The method of Claim 29, wherein the first and second substrates include SiO_2.

37. (Withdrawn) The method of Claim 29, wherein the first and second substrates include Si.

38. (Withdrawn) The method of Claim 29, further comprising generating a plurality of mated metal electrode pairs.

39. (Withdrawn) The method of Claim 38, further comprising generating wells between each mated metal electrode pair.

40. (Withdrawn) The method of Claim 29, further comprising:

removing substrate that is adjacent to the metal electrode within the via.

41. (Withdrawn) The method of Claim 40, wherein the metal plating includes one of Cr, Cu, or Au.

42. (Withdrawn) The method of Claim 40, further comprising applying a metal protective layer over the applied metal plating.

43. (Withdrawn) The method of Claim 42, wherein the metal protective layer includes one of Cr or Au.

44. (Withdrawn) The method of Claim 42, further comprising applying a conductive material adjacent to the metal protective layer within the via.

45. (Withdrawn) The method of Claim 29, wherein the metal electrodes include an alkali.

46. (Withdrawn) The method of Claim 29, wherein the first and second electrodes include Si and a metal and further comprising annealing the metal electrodes.

47. (Withdrawn) The method of Claim 29, further comprising attaching two or more solid state thermal engine devices together.

48. (Withdrawn) The method of Claim 47, wherein attaching includes attaching in one of a parallel or serial connection.

49. (Withdrawn) A method for cooling and converting thermal energy into an electric current, the method comprising:

etching a via through first sides of first and second substrates;

attaching metal electrodes to second sides of the first and second substrates, wherein the second sides are opposite the first sides;

mating the metal electrodes by bonding the second side of the first substrate to the second side of the second substrate to form a solid state thermal engine device, wherein an effective gap is formed between the two electrodes on the order of one nanometer; and

connecting one of the metal electrodes to a first surface and the other metal electrode to a second surface,

wherein the first surface has larger thermal energy than the second surface, and the connection with the electrodes causes a reduction in the thermal energy of the first surface.

50. (Withdrawn) A method of making a solid state thermal engine device for converting thermal energy into an electric current, the method comprising:

etching a via through first sides of first and second substrates;

attaching metal electrodes to second sides of the first and second substrates, wherein the second sides are opposite the first sides; and

mating the metal electrodes by bonding the second side of the first substrate to the second side of the second substrate to form a solid state thermal engine device, wherein an effective gap is formed between the two electrodes.